# Dentoalveloar Compensatory Mechanism in Skeletal Open Bite

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Summary

*The object of the study was to determine morphologic characteristics in subjects with skeletal open bite and increased mandibular angle; correlation between the depth of the over bite and values of the size of the angle of the mandibular base, maxillary base and intermaxillary angle; correlation between the depth of the over bite with values of anterior and posterior facial height and dentoalveolar compensatory mechanism in vertical type growth. The sample consisted of 77 laterolateral cephalograms of subjects with skeletal open bite of both genders, aged from 13 to 18 years. It was determined that 49.4% of the subjects had open bite, while 50.6% of the subjects were compensated, i.e. 41.5% had normal over bite and 9.1% deep bite.*

Key words: *open bite, compensatory mechanism.*

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## Introduction

Open bite is defined as an anomaly in which vertical contact between the teeth has been lost (1). Skeletal orthodontic anomalies, which include skeletal open bite, occur as a consequence of inadequate growth and development of the basal parts of the jaws and the area of the temporomandibular joint. During the period of growth unfavourable habits play an important role, although the matrices of growth of the maxilla and particularly of the mandible represent an important factor in the development of open bite, which can vary with regard to anterior and posterior rotation, resulting in changes in the size of the mandibular angle. More significant deviations in the direction and amount of jaw growth can lead to serious problems for the patient, primarily functional and later aesthetic. The most frequent form of open bite is anterior, which is characterised by lack of contact of the upper and lower anterior teeth, while posterior teeth are in occlusion. Lateral open bite and its combinations are rarer. Occlusal contacts and the extent of the over bite can have numerous variations, depending on skeletal and dentoalveolar characteristics. The aim of this study was to determine skeletal and dentoalveolar characteristics in subjects with skeletal open bite, i.e. increased mandibular angle, and potential dentoalveolar compensatory mechanisms in vertical type growth.

## Subjects and methods

Subjects were chosen from the records of the Department of Orthodontics, Dental Clinic of the Clinical Hospital Centre, Zagreb. Criteria for the choice of subjects was mandibular angle m-go-ar >127.5° +/-5.0°, erupted permanent teeth, apart from the third molars. All subjects with determined craniofacial anomalies, skeletal deviations in the sagital dimension, respiratory problems, and positive history of unfavourable habits were excluded from the study because of the possible effect on development of the alveolar bone and dimensions of the middle facial third. The sample consisted of 77 laterolateral cephalograms of subjects with skeletal open bite, of which 54 (70.1%) were female and 23 (29.9%) male, aged from 13 to 18 years. All subjects were classified according to vertical overbite (OB) into three groups:

- OB<0 mm; open bite
- OB= 0-4 mm; normal over bite
- OB<4 mm; deep bite

All cephalograms were recorded on appropriate paper on which skeletal and dentoalveolar variables were measured (Table 1, Figure 1).

Kolmogorov-Smirnov test was used to test normality of the distribution of data. Descriptive statistics was done for each variable. One way ANOVA was used to test the significance of the differences. Post hoc test according to Scheffe was then used to test the significance of the differences between the groups. All the tests were performed at the level of significance 0.05. Statistical package for Social Science 10.0 was used in the statistical analysis.

## Results

According to the depth of the overbite all subjects were classified into three groups: open, normal and deep. Open bite was determined in 38 subjects (49.4%), normal bite in 32 subjects (41.5%), and deep bite in 7 subjects (9.1%) (Figure 2). Kolmogorov-Smirnov test was used to test the distribution of data, which confirmed normal distribution of the sample. Tests for parametric statistics was therefore used $\chi^2$ test confirmed that there were no statistically significant differences between the male and female subjects, with regard to the depth of over bite (p=0.613).

Figures 3-5 show the descriptive statistics of the measured skeletal and dentoalveolar variables according to the depth of the over bite. Statistically significant difference was found between the groups (p<0.05) for the variable n-gn, which represents facial height (p=0.022), and for the variable spa-gn, i.e. the lower segment of anterior facial height (p=0.036). The anterior lower face height (spa-gn) and total anterior facial height (n-gn) were statistically significantly less in the group of subjects with deep bite (p<0.05) compared to the group with open bite. Statistically significance difference between the genders was found for the variables s-go, n-gn, n-spa and mia-ML (p<0.05). Dentoalveolar compensatory mechanism was analysed by means of the following linear variables: is-NL, isa-NL, ii-ML, iia-ML, ms-NL, msa-NL, mi-ML and mia-ML. In the group of subjects with deep bite statistically significantly decreased distance was found between the peak of the cusp of the upper first molar (ms-NL, mean value 22.86 mm, p=0.015) and its apex (msa-NL, mean value 3.5 mm, p=0.024) from the base of the maxilla, compared to the group with open bite. No statistically significance differences were found between the groups in the area of the incisor and the area of the first lower molar. As the analysis of variance showed differences between the groups of subjects regarding over bite of the incisors, post hoc tests were performed (Table 2) in order to determine between which groups the differences occurred. Variables ms-Nl and facial height statistically significantly (p=0.026) (p=0.023) differed between the groups with open and deep bite. Analysis of correlation (Table 3) showed that the depth of the over bite was in negative correlation with posterior facial height and lower anterior facial height, and in negative correlation with the following dentoalveolar variables: iia-ML, ms-NL, msa-NL, mi-ML and mia-ML.

**Discussion**

Some contradictory results can be found in available literature on dentoalveolar height in persons with long face syndrome. Schendel (2) reports that two variants exist for the cephalometric long face syndrome: with open and with deep bite, which he presented as superimposition of the facial polygon. The position of the incisors is almost the same in both groups. He considers that posterior lower facial height and height of the mandibular ramus are the main differences between the groups. The majority of clinicians consider that increased value of the mandibular plane inclination in relation to the cranial base (>40°) indicates the tendency to open bite, although several investigators disagree with this allegation (3). Skieller & Björk (4) demonstrate that increased mandibular angle is not a good predictor of facial growth and that persons with increased mandibular angle can have both types of rotation: anterior and posterior. Some patients have clinically visible open bite which is not visible by cephalometric criteria. Dung (5) reports that out of 250 patients with cephalometric indications of open bite, only 13% had clinically visible open bite, while Betzenberger (6) found the same in as many as 30%. It can therefore be concluded that although cephalometric criteria may suggest open bite it may not be clinically visible.

As early as 1931 Hellman (7) determined that out of 43 patients with open bite the percentage of treated patients was the same as self-corrected non-treated patients. In his study Worms (8) found spontaneous correction in 80% of subjects. In this study no difference was found in the values of the variables between genders, which corroborates an investigation carried out by Janson (9). Correlation between increased values of the intermaxillary angle and open bite has been confirmed by many authors (2.10-13). Kim (14) considers the reason to be in deviations of growth both in the maxilla and mandible. Cephalometric studies have consecutively confirmed that patients with anterior open bite differ from the rest of the population with regard to characteristics such as steep mandibular angle, reduced ratio of the upper to the lower facial height (2.15-19). Richardson (20.21) found significantly increased lower anterior facial height and intermaxillary angle in subjects with open bite. In spite of variations in intermaxillary relations normal occlusal relations can be maintained by compensatory mechanisms (22.24). Tanaka (25) considers that the primary factor of open bite is not only excessive eruption of the upper molars, but also vertical enlargement of the mandible and relevant alveolar bone. The molars are the first teeth to come into mutual contact, which stimulates eruption of the anterior teeth, attempting to follow the occlusal contacts.

In this study statistically significant difference was found for anterior lower facial height (spa-gn) and total frontal facial height (n-gn) between the groups with open and deep bite. Both variables are statistically significantly smaller in the group with deep bite. In his investigation Perera (26) found protrusion of the mandibular incisors as a compensatory mechanism. He noticed alteration in the position of the mandibular incisors, with the shifting of their apices towards the front. Thus this additionally confirmed Björkov's concept of increased mandibular prognathism with age. In the present study no significant changes were observed in the position of the points on the incisal ridges and apices of the mandibular incisors. Rajić - Meštrović (22) found more significant value of the inclination of the lower incisors in relation to the mandibular base in subjects with open bite. Several authors found steeper occlusal plane in subjects with open bite (2.27). Popovich (28) did not find significant difference in the dentoalveolar height of maxillary molars between subjects with class I and II, while Crawford (29) in the same subjects found difference in the lower anterior facial height. In this study the first upper permanent molars in the group with open bite erupted to a lesser degree in relation to the group with deep over bite. Statistical significant difference was also confirmed for the variable spa-gn in favour of the group with open bite. Other authors also confirmed increased frontal and total facial height (11.17). This was the only skeletal variable in the present study which showed statistically significant difference between the

groups. While monitoring growth in subjects with increased height of the lower facial third Nanda (11) found progressively decreased inclination of the maxillary plane and also increased posterior mandibular rotation. The same author (30) concluded that there were no differences in posterior facial height between the groups with open and deep bite. He also concluded that the formula for growth of any facial shape is established at an early age, even before the eruption of the first permanent molars and long before rapid growth in puberty. In this study statistical significant difference was found for posterior facial height (variable s-go) between the groups with different over bite.

**Conclusions**

On the basis of the study the following can be concluded:

- 50.6% of the subjects with skeletal open bite were compensated, i.e. 41.5% had normal over bite and 9.1% deep bite, while 49.4% of the subjects had open bite.
- No correlation was determined between the depth of the bite and the values of the size of the mandibular base angle, maxillary base angle and intermaxillary angle.
- Anterior lower height (spa-gn) and total anterior facial height (n-gn) were statistically significantly lower in the group of subjects with deep bite.
- In the group of subjects with deep bite statistically significantly reduced distance was found between the apex of the cusp of the upper first molar and the apex of the maxillary base.